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Reducing Energy Consumption Using Forced Wake Up In WBASN

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Abstract: Wireless Body Area Sensor Networks (WBASNs) are wireless monitoring systems, helps to monitor the human body using wearable and implantable sensor nodes. In a Wireless Body Area Sensor Networks, Longevity of the node and the network will be a very big key challenge, because of the inadequate energy supply in body sensor nodes. Our paper proposed Forced Wake Up method for the effective utilization of battery and to reduce the energy consumption of the sensor node as well as the network. This Forced Wake Up method will boost the life time of the node and network. In Forced Wake Up method one node will be in monitoring state while other nodes are be asleep state, so all the nodes energy can be saved by making its state sleep. Only when there is need of other nodes, then all other nodes forcibly wake up to monitor the human body. Periodically other nodes will be selected for monitoring human health in active state. This method will reduce the energy consumption in WBASN.

Keywords : *WBASN, network life time, Forced Wake Up*

I. INTRODUCTION

In recent years the worldwide population is increasing rapidly. Along with population new diseases are spreading over the world. So we are in needing to spent more money for the human health care. In order to reduce the cost of monitoring human health, we are introducing innovative technologies in human health care. Wireless Body Area Sensor Networks has emerged to monitor the human health remotely. The lifetime of the Body Sensor Nodes has to be increased to reduce the cost of the health care.

Energy Consumption can be reduced in many ways. We concentrated to reduce the energy consumption by using forced wake up method. This helps in increasing the lifetime of the node as well as the network. The nature of communications between a sensor node and a hub has a great impact on the power consumed. For instance, human health monitoring will be achieved by connecting body sensors to the body's surface and also inserting them into tissues for a more precise clinical practice.

Hence, major key challenge is to reduce the power consumption in order to protect human tissue. Nodes consists small batteries which contain less energy. The power of the node will depends on their activities in their respective cluster. Wireless body area sensor networks (WBASNs) have become one of the most promising technologies that facilitate human health monitoring at home. As a result, patients those who are in noncritical condition may be discharged from a hospital or clinic for home monitoring, once this technology is sufficiently mature. A very big advantage of WBASN is that lack of wires makes people to move freely in their home.

In this paper we have discussed about the introduction in Chapter I, and briefly explained about the challenges of body area networks. We have taken the literature survey from various papers and details explained in Chapter II. We

briefly discussed about our proposed Forced Wake Up Method and its algorithm in Chapter III. Finally we conclude our concept and also direct the future work in Chapter IV.

II. RELATED WORKS

Ubiquitous healthcare ensure that continual monitoring of human health and transfer the data to the health specialists. The main objective is to manage human health by continuous monitoring using tiny body sensors [1].

To increase comfort level of patients, Body Sensor nodes should be very small and batteries must work for years instead of days. Since the size of the sensor nodes are small obviously limits the batteries that will give power to the nodes [2].

The development of Wireless Body Area Sensor Networks involves many challenges like interoperability, scalability, reliability, energy efficiency and communication protocols, etc. Even though energy efficient communication protocols will increase the life time of network, due to reduction of transmit power human body may affect by the negative impact of electromagnetic radiation [3]. Since, the path loss in WBAN is usually larger than 50 dB [4], it may cause severe attenuation on wireless signals, and so, without sufficient transmit power the link quality is very likely to be deteriorated.

It is noticed that, with 1 mW transmit power at 2:4 GHz; the on-body (off-body) links of WBAN are intermittently disconnected up to 14.8% (14.9%) of the time when people sleep on bed [5].

An effective handoff protocol will be implemented by WBASN coordinators and APs, while the Received Signal Strength falls below suitable levels. For this, we prop up multiple radio channels in order to control the system's capacity, which allows monitoring multiple users in many rooms [6].

In [7] many studies have been done that involve nodes switching between an active state and sleep state. The variables include how to decide the active schedule or sleep schedule, the time period of the active/sleep period, and whether or not the nodes are aware of the schedules of the other nodes in the network.

To reduce the energy consumption and effective utilization of power, sleep wake up method will be useful for wireless body area sensor networks. Cyclic sleep wake up scenario has achieved good result in minimizing the power consumption in wireless body area networks [8].

III. FORCED WAKE UP METHOD

The schedule between the sleeping and awakening of sensors achieves the effectiveness of saving power by sleeping mechanism. The proposed sleeping control mechanism takes the dynamic scheduling method. We calculate the sleep probability for each level by the density. The nodes away from the sink will increase the sleep probability to decrease the forward frequency of the nodes near to the sink. In this way, the nodes near to the sink could share the energy consumption and preserve the energy.

For the wireless sensor networks, the sleeping scheduling is very important. If the nodes set into the active status for long duration, it will waste a lot of energy. We proposed the sleep awake concept. This sleep awake can be achieved in many ways like, cyclic wake up, randomly wake up and forced wake up. We used forced wake up method for reducing the energy consumption by the sensor nodes.

In our proposed method only one node will be in active state, and all other nodes are in sleep state. Only one node will monitor the human body, and it will awake all other nodes only if it sense abnormal data. By this method most of the body nodes are in sleep state, as a result the energy consumption of all other nodes will be reduced more and the longevity of the node and network will be increased.

The time of sleeping and awakening of sensor nodes will be vary according to the abnormal values sensed by the Body Node Coordinator. In sleeping control mechanism, there are two parts which are active status and sleep status. For

active status, sensor nodes could communicate with neighbor nodes. For sleep status, sensor nodes will suspend all communication to save energy.

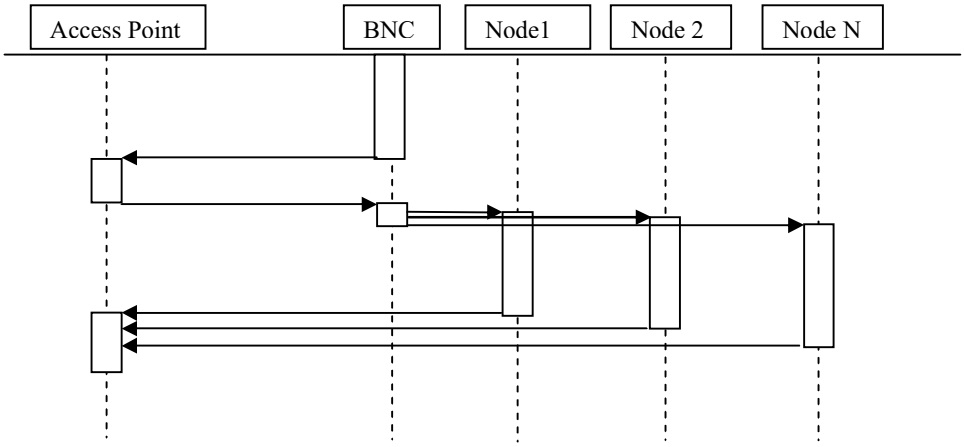

Figure 1: *Sequence Diagram representation of Forced Wakeup*

From the figure 1, the sequence diagram shows how the forced wakeup concept works. The Body Node Coordinator (BNC) senses the value from the human body and sends the value to the access point. The values then checked by the access point and if it is below acceptable level then it indicates the BNC. Then BNC will stimulate the other nodes forcibly to sense the corresponding values from the human body. Finally all the nodes send their values to the access point for the reference of health specialist.

Algorithm 1 explains how exactly the step by step process takes place while monitoring the human health using forced wakeup concept.

Algorithm1: *Algorithm for Forced Wakeup Concept*

Step1 : *Let us consider the initial no of nodes which are present in WBASN.*
Let N be the total no of nodes where N=1,2,...,n

Step2 : *Select the Body Node Coordinator i for monitoring the human body.*
Where $BNC_i \in N$

Step3 : *Make* BNC_i *will be in active state to monitor the human body.*

Step4 : *Make all other nodes will be in sleep state.*

Step5 : *Sense the value using the Body Node Coordinator*

Step6 : *Check the values sensed by* BNC_i
If BNCi value is acceptable level then continue step 5,
Else goto step7.

Step7 : *Awake all the nodes forcibly to sense the values.*

Step8 : *Alternatively select the monitoring node BNC periodically.*

Step9 : *Energy level will be maintained equally in all nodes of the network.*

Our Forced wakeup method allows for a node to be active during a randomly chosen in each time frame. This removes the necessity of time synchronization and makes the protocol implementation very simple. The idea is to have each node wake up once in every slot, be awake for a predetermined time, and then sleep again.

IV. RESULTS AND DISCUSSIONS

The proposed forced wakeup method implemented with the help of MATLAB. We had taken the transmitting range 10 meters and power needed for sensing the values by the node 30mA, initial battery power of the node is 2500 mAh, Data Transfer rate is less than one mega byte per second, and the minimum 2 nodes and maximum ten nodes are considered for the simulation.

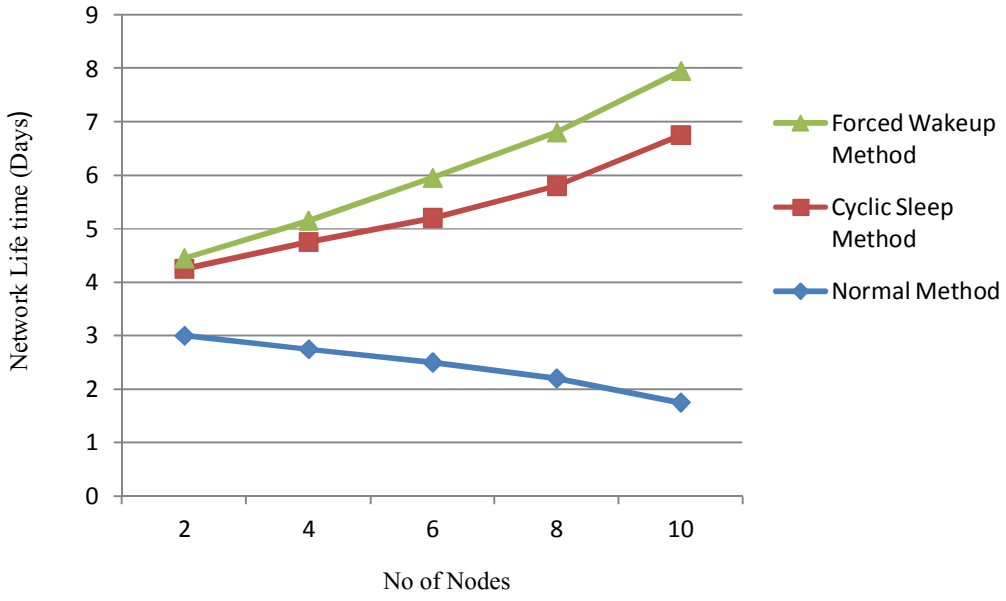

Figure 2: *Simulation Result of Forced Wakeup and Normal Method*

From Figure 2 Forced Wakeup method is providing good results when compare to the normal method and Cyclic Sleep method. It is clear that the forced wakeup method will increase the lifetime of the individual sensor node and also the whole network longevity will be increased.

Even though sleep wakeup scenario provides good result, our forced wakeup method will be increased the life time of the network than sleep wakeup and normal method. This comparison helps to analyze that the forced wakeup method provides better results that the other two. We have not considered the real time factors like the impact of air, moisture, etc. When we consider these real time factors it may vary in some values while comparing with the simulator results.

V. CONCLUSION AND FUTURE WORK

Reducing the Energy Consumption in Wireless Body Area Sensor Networks will be major key issue in recent years. We have conferred about the major key challenges that are faced in WBASN, and also we proposed a forced wakeup method to reduce the energy consumption of body sensor node and also increase the longevity of the network. Here we proposed the forced wakeup method; we further can take this into an advanced sleep awake mechanism for the effective utilization of the energy of nodes. We further concentrated on on-demand sleep awake concept (ie) awake the node only

when there is demand. Until that the nodes can be in sleep state. Future work can be concentrated on the above on-demand sleep awake method.

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